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BORNEO.

Borneo: Entdeckungsreisen und Untersuchungen; Gegenwärtiger Stand der Geologischen Kenntnisse; Verbreitung der Nutzbaren Mineralien. Von Dr. Theodor Posewitz. (Berlin: Friedlander, 1889.)

IN the work before us, Dr. Theodor Posewitz, of the Hungarian Geological Institute, gives the results of his three years' personal explorations in the Island of Borneo, with which he has incorporated the more important observations which are recorded in the literature of the subject. The larger portion of this literature being in Dutch, it is, as a whole, not very widely known; it is, accordingly, a matter of considerable importance to have it here summarized and critically examined by so competent an authority.

The three parts into which the volume is divided are: (1) Political and Historical; (2) Geological; and (3) Economic Mineralogy. Each of these parts is further subdivided into a number of clearly-defined sections, so that there is no difficulty experienced in at once mastering the range and contents of the work, which are further indicated by means of four excellent maps, showing respectively, (1) the routes of travellers, (2) the political divisions, (3) the geological structure, and (4) the distribution of useful minerals.

We are told, in Part I., that two-thirds of the island belong to the Dutch, but that the States on the north coast are more or less under British influence.

The history of exploration, as conducted by the Dutch, is treated separately from that which originated in connection with British colonial enterprise. During the last century, only one extensive journey was undertaken in Dutch Borneo, and scientific exploration was then altogether prohibited.

The genuine exploration of the country did not begin till 1820-30, when a Natural History Commission was established in Batavia, and its members undertook to investigate and describe various islands. Among others, Horner, G. Müller, Dr. Schwäner, and Von Gaffron devoted themselves to Borneo, and to the two last we owe our knowledge of South Borneo. Between the years 1850-60, systematic explorations for useful minerals were carried on by Dutch engineers in South-West Borneo, and these explorations have been recently resumed, after an interval of twenty years.

To Alexander Dalrymple, who travelled in 1769, we are indebted for our first knowledge of North Borneo; other early travellers were Burns, Hugh Low, and Spenser St. John, who visited Sarawak, Brunei, and the north-east coast, and ascended the Kina Balu Mountains. Among later travellers, Crocker and H. Everett merit special notice; as also do the courageous pioneers in the British North Borneo Company's territory—Dobrée, Peltzer, Wetti, Von Donop, Pryer, and F. Hatton.

With regard to the geological and physical structure, which are dealt with in Part II., we are told that there is no uninterrupted central mountain chain in Borneo, though such is represented on most maps. Isolated

mountains occur at intervals, surmounting table-lands which extend in a north-east to south-west direction; but it is not yet decided whether a regular chain exists in any part of the interior. The Kina Balu Mountains, which have a maximum elevation of 13,698 feet, are, so far as is at present known, the highest in the island; they are situated in the territory of the British North Borneo Company.

The largest rivers—the Barito, Kapuas, Redjang, and Mahakkam—rise in the centre of the island.

The geological structure is remarkably free from complexity. The isolated mountains are of slate or schist penetrated by granite and diorite—conditions, it may be remarked, which are in many countries accompanied by the occurrence of mineral veins; this also seems to be the case in Borneo.

Succeeding these are rocks of Devonian age, in which auriferous veins occur. Till quite recently no formations had been recognized between them and the Tertiary deposits which have long been known, but Carboniferous strata (mountain limestone), which it is believed occur throughout a large area in Northern Borneo, have within the last few years been recognized, and Cretaceous rocks have been discovered in a single locality in West Borneo.

Tertiary formations belonging to several subdivisions are distributed over considerable areas; they form the plateaus through and above which the mountain chains rise. The older Tertiary strata were first studied by Verbeek and Pengaron in South Borneo. They are divisible into sandstone, marl, and limestone groups. The majority of the coral deposits occur in the sandstone, and the limestones consist mainly of wide-spreading coral reefs. These older Tertiary strata are often much disturbed and broken by intrusive masses of andesite. Oligocene strata are only known in East Borneo, where they include extensive deposits of coal.

The diluvium of our author is of considerable economic importance. It spreads over wide undulating tracts surrounding the Tertiary hills. It includes the principal sources of the gold and diamonds which, together with coal, constitute the most valuable mineral resources of the island. From the diluvium to the alluvium which is in process of formation at present, there is a gradual transition.

There are no evidences of any post-Tertiary volcanic energy in Borneo. The Kina Balu Mountains, at one time thought to be volcanic, are now known to consist of ancient eruptive masses. Earthquakes occur, but rarely, and so far as is known they originate in neighbouring islands.

In West Borneo a deposit which appears to be identical with one form of Indian laterite, is described as resulting from the weathering of the rocks. A similar laterite occurs near Singapore.

Taking a general survey of the probable geological history of Borneo, it appears that, up to the beginning of the Tertiary period, what now forms one united island consisted of an archipelago like that between Singapore and Banka. After the deposit of the Tertiary strata there followed a period when the island had the form of the Celebes. A tradition among the natives, that the sea formerly reached to the foot of the mountains, is referred

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to as confirming the view that the present form of the island has only been acquired recently.

The useful minerals are described in Part III., and their distribution is indicated on the map already referred to. Of most of them Dr. Posewitz has previously published separate descriptive monographs.

The rich coal-fields are first described. The seams are exposed in many river cuttings in Sarawak and Brunei. Coal also occurs on the Island of Labuan and in Sabah. There are said to be rich and extensive deposits in East Borneo also, but they have not been worked.

Gold is of the next importance to coal as a mineral product. Mining in the older formations has hitherto not proved remunerative, the best field being from the diluvial deposits, which are worked almost exclusively by Chinese. The richest gold regions are in the south-east, near Tanah Laut and Kusan, on both sides of the auriferous Meatus Mountains; and in the north-east, in the Chinese districts of West Borneo and Sarawak. Recently, what promise to be rich gold deposits have been discovered in the Upper Segamah River in Sabah.

The production of gold was much more considerable formerly than it is at present. In West Borneo it amounts annually to 120,000–150,000 kilogrammes, and in Sarawak it amounted to 28,281 kilogrammes in 1886.

Diamonds are not, comparatively speaking, so abundant as gold, but they occur in the same deposits. They are searched for by Chinese. Since the introduction of the cheaper Cape diamonds, the production has fallen. In 1884, 2727 carats were exported from West Borneo, and 1200 carats from Sarawak in 1886.

Dr. Posewitz refers to the late Prof. Lewis's speculation as to the connection between diamonds and serpentine (*Peridotite*) (NATURE, vol. xxxvi. p. 571), but states that it is not yet known how far his conclusion is correct, that diamonds and platinum are only found in Borneo in streams which traverse areas containing serpentine. Indeed, it may be added that serpentine is of rare occurrence in the principal diamond regions of India, and in some of them none whatever has been observed.

The famous "diamond" of 367 carats, known as the "Matan," from the territorial title of the Rajah to whom it belongs, has been estimated to be worth £269,378 (Crawford). The Dutch made very large offers of money and warlike material for it early in the present century, but these were always refused. The stone, it now appears, was examined in 1868, and proved to be only a rock crystal with a specific gravity of 2.63, thus confirming doubts previously expressed as to its being really a diamond.

Platinum is of very local occurrence in Tanah Laut only.

Antimony and quicksilver only occur, so far as is known, in sufficient quantities to be regularly mined in Sarawak.

Iron ores are widely distributed, but are of no present economic value. The introduction of cheap European iron has put an end to the native iron industry, as is the case, too, in many parts of India.

Dr. Posewitz states that the condition of mining industries generally in Borneo is at present very poor. In the south, private coal-mines existed, but were put an end to by an insurrection. The well-known Government mines at Pengaron ceased working after thirty-six years'

existence, as they were no longer remunerative. A private company has now commenced to work valuable mines on the east coast. In Sarawak, mines have been worked by the Government since 1881, and in 1886 produced 44,167 tons. In Labuan, mines were also worked for some time, but are now closed. The principal source of supply at present is from Brunei (Muara coal). It is hoped that in the British North Borneo Company's territory extensive workings of gold and coal will be established.

It is impossible to give here an adequate idea of the careful details with which each topic discussed in this work is illustrated. At the same time there is a highly meritorious conciseness of treatment which, together with the soundness of the author's views and his careful quotation of his authorities, makes the work a text-book for which it is to be hoped that a competent translator into English and an enterprising publisher will be found. It is emphatically a work which was much wanted, as our knowledge of the geology of this important island has hitherto been most fragmentary and imperfect, and we trust, therefore, that ere long, steps may be taken to make Dr. Posewitz's labours better known to English readers. V. B.

GRAPHICS.

Graphics; or, the Art of Calculation by drawing Lines, applied especially to Mechanical Engineering. With an Atlas of Diagrams. By Robert H. Smith, Professor of Engineering, Mason College, Birmingham. Part I. (London: Longmans, Green, and Co., 1889.)

MAXWELL was the first, according to the Introduction of the present treatise, to state the principles in a very complete and general manner by which stress-diagrams are drawn, in the *Phil. Mag.*, xxvii., 1864; and also in the *Trans. Roy. Soc. Edinburgh*, vol. xxvi.

But Maxwell himself is careful to point out that he derived the original idea from Mr. W. P. Taylor, or at least was unaware of his previous use of the method.

The method is of much greater antiquity, and can be traced through Moseley's "Mechanical Principles of Engineering and Architecture," 1843, to Hutton's "Course of Mathematics," 1811, and probably still further back.

It is, however, only of recent years that Maxwell's treatment has been followed up and developed by Cremona, Culmann, von Ott, and others; and now the method is considered indispensable in practice for the calculation of the stresses in bridges, roofs, and engineering and architectural structures generally.

Two great advantages of the graphic method recommend it to the practical man—the first, that the diagram is itself a check upon the correctness of its construction; and the second, that the numerical results of the diagram are read off on a scale only to the really practically significant number of figures, the very roughness and imperfection of the draughtsman's work showing the margin of variation to be allowed for.

As to the relative rapidity of the graphic method compared with ordinary numerical calculation by logarithms and arithmetical processes, the author points out that, while for a single isolated calculation the graphic method may easily be distanced, it is in the long-continued series of